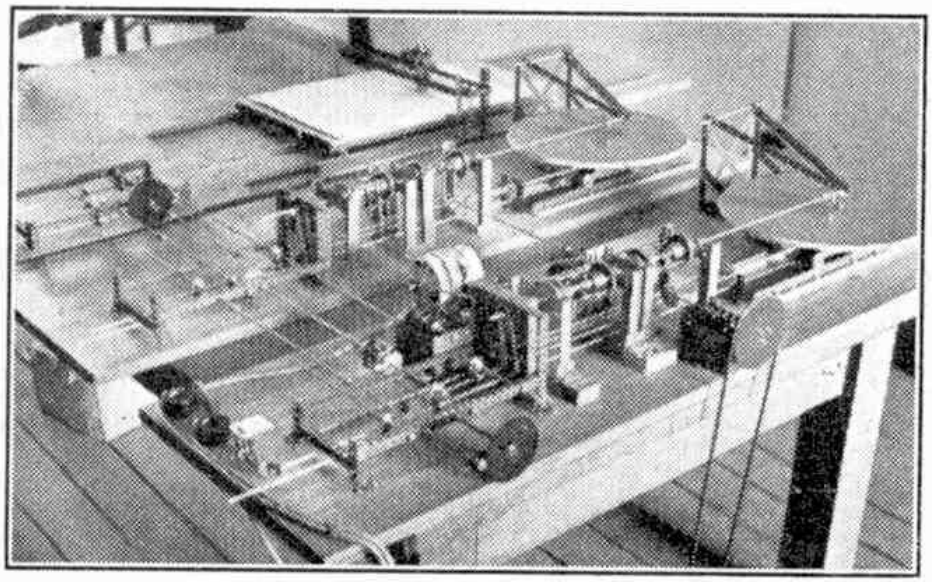
# A Meccano Calculating Machine

## Solving Complex Mathematical Equations

A WONDERFUL Meccano model constructed by Professor D. R. Hartree, then of Manchester University, was described and illustrated in the "*M.M.*" for June 1934. The purpose of this was to solve complicated mathematical equations, a task that it performed accurately and far more quickly than was possible by ordinary calculations. Its original, to which the name differential analyser was given, had been designed and constructed by Professor V. Bush at the Massachusetts Institute of Technology, in the United States. After seeing photographs of this machine Professor Hartree had the impression that someone had been enjoying himself with a large Meccano Set. This suggested building a differential analyser of Meccano Parts, and the demonstration model that he constructed actually proved of use in his own research work. Other successful Meccano reproductions of the machine followed, and on this page we illustrate one that has been constructed at the new University of Malaya, Singapore, by Professor J. C. Cooke.



**The differential analyser built of Meccano parts by Professor J. C. Cooke University of Malaya, Singapore.**

This remarkable machine can add, subtract and multiply, and in addition it carries out a more complicated process known as integration. It works with a series of shafts turning at various speeds. These shafts, built up of Meccano Axle Rods, can be seen on the left of the photograph of Professor Cooke's model. For adding two terms in an equation shafts are made to rotate at speeds corresponding to them and by means of differential gearing these turn a third shaft at a rate corresponding to the sum. Multiplication is effected by simple gearing in a similar manner.

For integration, which is the central purpose of the machine, the round tables seen on the right are used. These are made of bakelite. The mechanism of each table is connected by cross shafts to the appropriate shafts on the left, the drives being given by bevel or helical gearing. One of the cross shafts rotates the table, and a second acting through a Screwed Rod moves it towards or away from the rest of the machine. Resting on the table is a Bush Wheel and the shaft of this is connected to a third shaft on the left. As the table rotates it turns the Bush Wheel, at a low speed when this is near the centre of the table and at a higher speed when it is nearer the circumference. This variation in speed enables the device to accomplish the type of summation that mathematicians call integration, and the result is transmitted to one of the shafts on the left.

The results of all these operations are represented by the rates at which the final shafts in the model turn. In some cases the turning of these shafts is made to draw a curve that represents the "answer." In others revolution counters are turned to give direct numerical result.

Professor Cooke's model is not just a toy, or even a demonstration model. It is a mathematical calculating machine capable of serious work, and its success emphasises the judgment of Professor Hartree, that such machines are a striking tribute to the practical value of the Meccano system.